■ *homework check:* **FCM 11 p. 428 # 1 – 11**

■ *note:* **Compound Interest**

Compound interest is the interest paid on the principal and the accumulated interest. The formula for compound interest is $A = P(1+i)^n$ where A is the amount after interest has accumulated (or the future value), P is the principal originally invested, I is the rate of interest per compounding period, and n is the number of compounding period. For example,

a)   What is the amount of the investment after 6 years if $2500 is invested at a rate of 6.5% compounded monthly?
$6.5\% = 0.065$

monthly rate $\dfrac{0.065}{12} = 0.0054166$

number of compounding periods $= 12(6)$
$$= 72$$

$A = P(1+i)^n$

$A = 2500(1+0.0054166)^{72}$

$A = \$3688.55$

b)   What is the amount of interest earned on an investment of $3750 in 5 years at a rate of 3.6% compounded quarterly?
$3.6\% = 0.036$

monthly rate $\dfrac{0.036}{4} = .009$

number of compounding periods $= 5(4)$
$$= 20$$

$A = P(1+i)^n$

$A = 3750(1+0.009)^{20}$

$A = \$4485.95$

$I = A - P$

$I = 4485.95 - 3750$

$I = \$735.95$

❖ *homework assignment:* <u>FCM 11</u> **p. 432 # 3, 5, 7, 9, 13, 15**

Key Concepts

- Compound interest can be accumulated at various intervals, such as annually, semi-annually, quarterly, and monthly.
- The compound interest formula $A = P(1 + i)^n$ can be used to calculate the future value, or amount.
  - A is the future value or accumulated amount of an investment or loan.
  - P is the principal.
  - i is the interest rate, in decimal form, per interest period.
  - n is the number of compounding periods.

Discuss the Concepts

D1. Draw a timeline to illustrate each situation.

a) an investment of $1000 at 5% per year, compounded semi-annually, for three years

b) an investment of $550 at 4% per year, compounded quarterly, for two years

c) an investment of $700 at 3% per year, compounded monthly, for two years

D2. You can use the same compound interest formula, $A = P(1 + i)^n$, for both debts and investments. Explain why.

Practise (A)

For help with questions 1 to 3, refer to Example 1.

1. Evaluate. Use a scientific calculator and round to two decimal places.

a) $500(1.02)^3$

b) $200(1.03)^7$

c) $1000(1.06)^4$

d) $3500(1.0025)^8$

e) $1350(1.0375)^{12}$

f) $12\,500(1.041)^5$

2. Substitute the values into the formula $A = P(1 + i)^n$. Do not evaluate.

a) a $2000 investment at 5% per year, compounded annually, for three years

b) a $1000 loan at 8% per year, compounded semi-annually, for two years

c) a $50 000 loan at 12% per year, compounded quarterly, for five years

d) a $750 investment at 6% per year, compounded monthly, for one year

3. Determine the amount of, and total interest earned on, a $1000 investment at

   a) 4% per year, compounded annually, for five years

   b) 8% per year, compounded semi-annually, for three years

   c) 6.5% per year, compounded quarterly, for two years

   d) 3.6% per year, compounded monthly, for four years

For help with question 4, refer to Example 2.

4. To pay for a vacation, Ming Mei borrowed $900, at 6% per year, compounded quarterly. The loan must be paid in full after two years.

   a) How much must Ming Mei repay?

   b) How much of that amount is interest?

5. Keisha plans to invest $5000 at 6% per year for five years. Calculate the amounts Keisha would have at the end of the five years if the interest is compounded

   a) annually   b) semi-annually   c) quarterly

   d) monthly   e) daily

Apply **B** •

6. When Tonya was born, her grandparents invested $10 000 at 5% per year, compounded semi-annually, to pay for her education.

   a) What was the investment worth on Tonya's twelfth birthday?

   b) What was the investment worth on Tonya's eighteenth birthday?

7. A certain investment fund has grown by an average of 13.6% per year, compounded annually, over the past eight years. How much would an investment of $2000 made eight years ago be worth today?

8. A $5000 investment earns interest at 4% per year, compounded quarterly, for 10 years.

   a) What is the value of the investment after one year? two years?

   b) What is the interest earned in the second year?

   c) What is the interest earned in the tenth year?

   d) Explain any differences between your answers in parts b) and c).

9. Wayne invested $2000 at 4.5% per year, compounded semi-annually, and $2500 at 4.2% per year, compounded quarterly. Both investments were for three years.

   a) Which investment earned Wayne more money?

   b) What is the total interest earned on Wayne's investments?

10. To buy a car, Sangar borrowed $8000 at 4.8% per year, compounded monthly, for one year. His brother, Sanjiv, borrowed $8000 for his car, at 3.2% per year, compounded monthly, for one year. How much more interest did Sangar have to pay than Sanjiv?

11. To find current interest rates for car loans at financial institutions across Canada, go to *www.mcgrawhill.ca/links/foundations11* and follow the links.

a) Which institution charges the lowest interest rate on a 60-month loan? Which institution charges the greatest interest rate?

b) If interest is compounded monthly on a $15 000 loan, compare the total interest paid on the loan using the two interest rates from part a)?

c) Select one institution's 48-month loan interest rate. Compare the total interest payable on a $15 000 loan
   i) with simple interest
   ii) with interest compounded monthly

12. Warren needs to borrow $3000. Which loan should he take? Justify your choice.

A $3000 for five years at 9% per year, compounded semi-annually

B $3000 for five years at 8.6% per year, compounded quarterly

13. The town council voted to issue a bond of $3 000 000 to build a new swimming pool. The bond matures in 10 years, with an interest rate of 5% per year, compounded semi-annually. Principal and accumulated interest are due at the end of the term.

a) Calculate the total amount that the town must pay at the end of the term.

b) Calculate the total interest paid.

14. The city of Melville has a population of 102 000 and a projected growth rate of 2.3% per year, for the next 10 years. The city of Markton has a population of 97 000 and a projected growth rate of 3.7% per year for the next 10 years. Which city is expected to have the greater population in 10 years? By how many people?

15. The Stereo Warehouse is advertising "No money down and pay no interest for one year!" Peter read the fine print and discovered that, although you pay no interest for one year, interest is calculated at 12% per year, compounded monthly, on the price of the merchandise. What would Peter have to pay for a $1150 stereo after one year?

16. Danielle received an inheritance of $30 000. She wants to split the amount equally among her three children, Robert, David, and Donna.
- Robert plans to buy a house in the near future so he will need the money available. He deposits his portion into a bank account paying interest at 4% per year, compounded quarterly.
- David plans to go to university in a few years. He invests his money in a registered education savings plan (RESP) that pays at 5.5% per year, compounded semi-annually.
- Donna will not need her money for many years. She puts her portion into a trust fund. The fund pays interest at 8% per year, compounded monthly.

  a) Find the amounts available to each child after two years. What are the differences between the amounts?

  b) What will happen to the differences between the amounts if the money is invested for a longer time?

Extend C

17. Sarah deposited $2000 in an investment fund that earned 12.6% per year, compounded annually. After five years, the proceeds were reinvested in a second investment fund that earned 15.8% per year, compounded semi-annually. If the second fund continues earning at the same rate, how much will Sarah's investment be worth after an additional five years?

18. Determine the yearly interest for each investment.

a) After six months, a $500 investment with interest compounded semi-annually is worth $512.50.

b) After two months, a $2000 investment with interest compounded monthly is worth $2020.05.

c) After six months, a $1000 investment with interest compounded quarterly is worth $1025.16.

19. Bryce bought a savings bond during a recent Ontario Savings Bond campaign. The interest rate increases every year according to the table.

a) How much will Bryce's investment be worth in five years if he invests $500?

b) How much will Bryce's investment be worth in five years if he invests $1500? Use your answer to part a) to determine the value.

Year	Annual Interest Rate (%)
1	3.7
2	3.8
3	3.9
4	4.0
5	4.25